

# Economic Instruments to Fight against Risk of Marine Pollution

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## Abstract

The operations of the major industrialized economies are largely reliant on the availability of oil resources. Production and consumption sites of this raw material are often in total geographical disconnection. Oil shipping remains the most expensive means of transportation. This activity is risky and complex. "Risky", since accidents are a source of environmental and economical damages; considerably important enough to obscure the rare nature of such disasters.

And "Complex", for there are many actors and intermediaries; often of different nationalities and are sometimes difficult to be identified.

Risk is an important concept particularly in the fields of industry, environment (industrial risks, major risks), finance, law, health, and of course insurance.

Worldwide, stakeholders are demanding ever-higher levels of environmental and social performance from the industry.

As a result, oil and gas companies are being exposed to a steady proliferation of policies, laws, guidelines and other norms applicable to their activities.

Energy consumption by shipping is the source of many pollutants. The maritime oil risk can, in case of realisation, cause oil pollution damage of which costs have had an increasingly big importance.

## Keywords

*Risk; Tanker, Externality; Pollution; Environment; Oil*

## Acronyms

**IMO** International Maritime Organization

**OPA** Oil Pollution Act

**MARPOL** Marine Pollution

**(IOPC FUNDS)** The International Oil Pollution Compensation Funds

**IFCP FIIPOL** International Fund for Compensation for Pollution

**OECD** Organization for Economic Co-operation and Development

**ISM CODE** International Safety Management Code

**SOLAS** Save of Live at Sea

## SDR Special drawing rights

## Introduction

The exploration and production of oil, gas and the energy infrastructure projects associated with it are increasingly taking place in the world, they influence the diversity of environmental parameters and socio-economic from the Arctic to tropical and humid regions.

Oil tankers can have very different sizes. They are classified according to their transport capacity measured in tones of crude. In 2008, the equivalent of 54 million barrels, about 7.2 million tons of oil, has circulated daily by sea. This equates to 2.6 billion tons of oil transported by sea this year alone, against 500 million in 1960 and 100 million in 1935! Thus, in response to a constantly increasing demand, the oil freight (transportation of crude but also fuel, fuel or basic products for the petrochemical industry) continues to grow (AMIC 2006). For 2008, it was even a third the volume of world maritime trade. Energy consumption by shipping is the source of many pollutants.

Shipping is considered one of the means of transport that causes little harm to the environment, it may have important effects if standards are not observed or are not enforced.

The shipping company must manage after identifying risks and knowing how to transfer those risks to insurers, sovereign states, take offs to the maritime adventure, as the sea still remains a wild world.

However, there are two opposite views here, on the one hand, economists in favour of active intervention of the state (tax or regulatory approaches) and on the other hand, economists advocating free negotiation between polluters and the polluted (Contractual approach, and mechanism of pollution rights).

### Involvement of Contributors

Risk management is based on a detailed knowledge of the business environment. This cannot be without the involvement of enterprise contributors; the only ones capable to provide some information about the risks that are close to their activity. (Such a distributor seems increasingly reluctant to distribute the company's products, such as concurrent, as customers are conducting aggressive exploration activities; the reactions of customers degrade such type of products, and such infrastructure shows signs of aging, while the internal social climate the company is seen as more and more tense ...). This requires a simple but effective structure for allowing the collection of information "field" and feedback. A Wide dissemination of information helps to strengthen risk management (prevention ...) and involves new postures (sharing, collaboration).

### The Enterprise's Analytical Capacity Increase

The centralization and standardization of information flow will allow the expertise and decision makers to supplying continuous dashboards and alerts, facilitating rapid access to information which is classified and prioritized for the collective analysis by internal and/or external experts.

The challenge of risk management will be to set up such systems and to have access to information.

This is a culture that will strengthen the company, not in the simple defensive point of view but to the extent that they contribute to increase its competitiveness and hence its sustainability.

### Shipping as a Center of Risk

The shipping company operates in an open global competitive context, said free rivalry. The sea trade uses important means of transport (ships increasingly gigantic) but every year many ships perished accidentally and despite the technical and human resources in place, new risks emerge (pollution, insecurity) or reappear (risk of war), new international conventions follow these events by trying to govern together and unify the world through free trade (LEROY 1992). Maritime transport, which reports to the Maritime Law, is all about «sea risk, which requires solidarity - (not legal in the sense of the word) - between participants in the maritime shipping and a risk division, particularly since more goods that carried risks have been expensive ".In origin, the

Maritime Law has a new and original character (positive law) remarkable implementing institutions such as the general average, insurance, and Bottomry loan (in-existing nowadays).The shipping company has always tried to protect its interests in its relationship with shippers, Brussels Convention and the Protocols are amended so as to limit its cargo liability . Major maritime disasters have led States to react through international conventions: The Titanic disaster will lead to the SOLAS (Safety, ship classification and marine salvage); disasters lead to closer agreements on marine pollution, the introduction of the ISM Code and STCW regulations providing complementary constraints to the shipping.

### How Could a Firm Manage Its Environment?

How a firm can manage its environmental impacts is a good determinant of how it manages its overall business. The experience has shown that the good environmental management not only yields financial savings but also leads to efficient business practices (Ruffieux 1991). In our economies which are subject to globalization, the firm relies on a strong sense of network interconnection. The (physical, technical, legal, economic, social, media ...) exchanges with its environment are irregular, and the dependencies (suppliers, economic and political conjuncture, public opinion, bad weather ...) are unavoidable. The firm must introduce a number of measures to reduce the environmental impact of its office operations (Idelhakkar. 2011).

### Risk Evaluation of Oil Transport

Due to the severe consequences of oil spill, the operation of oil tankers represents a significant risk to the environment. Tankers are the largest contributor by vessel type to worldwide spill volume (Bertrand 2000). The economic risk in oil shipment is a nautical risk (boarding, stranding), fire, explosion, hull breach, and the risk of pollution: the stronger risk aversion.

Legal risk is: based on the concept of responsibility and on the legislation coming into effect over the international plan, OPA conventions, Brussels conventions of 1969 and 1971 and the MARPOL convention.

Two Brussels conventions determine the legal framework. Civil liability of the oil carrier corresponds to the convention of 29th November 1969; that asks to compensate victims of pollution damage (108 million Euros). The second agreement, signed on 18th December 1971, calls for the creation of an

international fund for compensation against damage caused by hydrocarbons pollution (IOPC funds, FIPOL).

It came into effect in 1978. The convention complements the 1969 convention of civil liability and provides additional compensation for damage related to pollution in so far as protection under the 1969 convention was adequate.

However, the bound funds have been limited to an amount not to exceed 30 million SDR 45 million (and including previous \$ 19 million). Contributions to the fund are paid by anyone who receives oil transported by sea in Contracting State.

The MARPOL convention has bound—in its terms, starting from 05th April 2005, and ship-owners to send decayed tankers over 25 years old to breakage.

The preliminary risk approach: developed at the beginning of the 1960s in the United States; it is the identification of risks by the definition of the means (prevention, protection and procedures.....).

It is to draw up a dashboard with all factors that affect the overall safety of ship carrying oil. This will particularly lead us towards the application of the rules relating to maritime navigation.

This preliminary approach to risk is also based on the lessons of history. The maritime accidents that happened yesterday can be tools and basic parametric models of the control panel defined above (Idelhakkar 2010). Risk control must allow several objectives: first to enter the security aspects, identify risks then prescribe immediate corrective actions in the best conditions of efficiency, delay and cost...

However, in the case of marine oil transportation, we have stressed that it is a question of the coverage plan with two dependent risk sources. And the implementation of the oil vessel body risk may result in the risk of oil pollution of the seas and coasts. However, if the first risk is fully covered by regular insurance, the second is not.

### Economic Reflections on the Environment

Economic reflections on the environment are relatively recent: The founder Article of the theory of natural resources (price trends laws and comparison of the rates of extraction depending on the competition regime) appeared in 1931. The broader issues of management of scarce (oil) or renewable (fisheries) resources are an even more recent concern toward which the public is

sensitized.

As evidence, the rise of environmental concerns the global warming economic and political issues (Kyoto Protocol ...).

Managing risks associated with the energy industry is becoming increasingly complicated due to factors such as government regulations, public policy, financial concerns, and energy resource scarcity. In order to address these issues, impacted companies often implement energy risk management strategies (Kast. and Lapied. 2004.) This involves the process of pinpointing, evaluating, and prioritizing risks associated with uncertainty in the energy markets. Controlling energy risks can provide greater market assurance for companies like oil and gas producers, electric providers, and gas utilities. It can also give confidence to the insurance companies, banks, and manufacturers who work with these energy companies.

### Oil Pollution and Marine Environmental Law

How is the environment integrated in our market economy? The traditional approach, consisting of regulating the most possible, has shown its inability to solve environmental problems. A new approach, which is more flexible and more efficient in combining regulatory and economic instruments, should lead to improve both economic and ecological results to fight against pollution.

In the early 1970s, governments began to intervene in the field of environmental protection by using a regulatory arsenal and direct controls. Parallel to this legislative process, a new—economic—approach appeared. It came out from the theory of externalities, by which the phenomena of pollution and environmental degradation are due to the lack of an adequate pricing of environmental resources: if we give a full price for these assets, their users (especially polluters) will take the necessary measures to limit their consumption and deterioration, rather than wasting them when they are uncharged (free).

Therefore, it is convenient to first examine the theory of externalities, which is the basis for the economic approach to the fight against pollution. Then we'll see how this theory gives rise to economic instruments for environmental protection.

### The Contribution of the Theory of Externalities

We can define the externalities (or external effects) as follows: "an external effect occurs when a person's

activities affect the functions of production or the welfare of others, who have no direct control over those activities "(Kolm, 1971)". An external effect is an external economy or an external diseconomy whether it is favorable or not to the person who undergoes it." In the environmental economy, the negative externalities occur most often.

The externality characterizes a situation where the economic action of an agent provides advantages (positive externalities) or disadvantages (negative externalities) to one or many other agents; such interdependence finds no adjustment on the market.

A company that pollutes a river creates negative externalities to all residents and businesses located downstream of the pollutant firm. When a tanker empties its tanks in the international waters or when toxic smokes degrade the air quality, officials embarrass fishermen and inhabitants without spontaneously setting any price for such nuisances.

In case of externalities, the price system ceases to carry on its function of information and incitement. It does not guide the agents towards more socially optimal decisions which may lead to various forms of inefficiency in the organization / activities of production and consumption.

### The Market Failure in the Presence of Externalities

Generally, prices correctly measure the social values of a property that is the supplement or reduction of potential welfare for the community no matter what their production or use is by a particular agent. The price system is a kind of common denominator that summarizes all the interactions between agents and allows an assessment of collective welfare; competitive price system guides agents to an efficient use of available resources to the community.

There are, however, cases where prices do not play this role that the theory assigns to them, and where the costs and benefits differ from private costs and benefits to the community. These are situations where the decisions of consumers or producers of an agent directly affect the satisfaction or benefit of other agents without evaluating the market and make the agent pay for this interaction: externalities.

In case of externalities, the price system ceases to hold office for information and incentives; it does not guide the agents towards more socially optimal decisions and results in various forms of inefficiency in the

organization of activities, production, and consumption.

Those affected in the case of external economies, do not pay the price in return for the benefits they enjoy as if they were –in contrast- affected by the activity of the mover of the externality; they have no power to make restitution. Production is optimal in the presence of externality because some costs are not taken into account. All social costs of an activity, giving rise to external economies, will not be supported by the responsible, and his activities will likely be extended

### Economic Instruments to Fight against Pollution

The British economist Arthur C. Pigou(1877-1959), who first, proposed to tax externalities in the environmental field. It aims to internalize the external costs or damages that the firm imposes on society and the environment. This is not a tax but a price, the producer takes into account not only its individual costs of production but also in its social costs (externalities) caused by its operations. The problem of course is to quantify the damage in monetary units. This estimate is very difficult in practice and the Pigouvian tax -an optimal and theoretical tool- cannot be applied in this form. The concept, however, provides a theoretical basis for economic instruments increasingly used in OECD countries (OECD, Paris, 1991), such as taxes, fees, deposit systems, the financial markets or the creation of a "permit to issue (rights to pollute). All these instruments have the advantage of giving a price to the pollution and thus lead to a better allocation of resources.

### Contractual Approaches

Ronald Coase indicated that government intervention is not automatically required; he also highlights the true foundation of such an intervention. The state action is justified when the high number of partners and / or complexity of externalities involve entail transaction costs so that no mutually beneficial agreement and establishing the optimal allocation of resources cannot be spontaneously negotiated (Arrow 1951).

The Coase Theory also is read as follows. If property rights are fully defined, if transaction costs are zero and if the information concerned is perfect agents, negotiation among these agents enables a situation of Pareto-optimal. In addition, if the distribution of

property rights does not generate income effect, the optimum obtained will be the same, whatever the structure of property rights is.

The invalidity of the income effect related to the allocation of property rights: suppose that the Stationery initially owns a River. If this right is removed to be attributed to the water treatment plant, it sees its economic situation improve (increase in its "income" in the broadest sense). Say that the income effect is zero; this change has no effect on its marginal willingness to pay for a less important pollution. Under these conditions, bargaining between the two firms will lead to the same result (Pareto optimal) as Stationery has the right to pollute the river or the treatment plant has the right for a clean river. Coasian solution to the problem of externalities is a "market" procedure of the internalization of externalities, which means that a market of externality rights has to be created. This procedure relieves the state to intervene, apart from ensuring respect for property rights. So as this bargaining can take place, it is necessary that the rights of agents are clearly defined. In the case of the factory that pollutes a river, it is about who owns the rights to the river water. Do they belong to river users, who are then entitled to a clean river? Or do they belong to the company, which then has the right to pollute the river? If property rights are well defined, then a Pareto-optimal situation may result from free negotiation between the agents involved in the externality.

### Environmental Taxes

The principle of the polluter-payer (PPP) (OECD 1972) obliges the generator of the externality to bear the social costs of its actions to realize an effective Pareto equilibrium.

The Administration should impose a tax on the externality in order to restore equality between social costs and private costs.

Indeed, in a context of pure and perfect concurrence, the selling price of the good implicated in the production of the externality must reflect the total social cost that imposes to society.

Thus, all information will be included in the new price.

### The Mechanism

Let's suppose that the tanker ship A supports a tax unit  $t_A$  of the amount of externality (causing an oil spill

pollution) which it generates ( $E_A$ ).

$$\begin{cases} \text{Max } \pi_A(q_1, q_2, \dots, q_n, E_A) = \sum_{i=1}^{i=n} p_i q_i - t_A E_A \\ \text{subject to } F_A(q_1, q_2, \dots, q_n, E_A) = 0 \quad (\lambda_A) \end{cases}$$

The first order conditions of the program lead to

$$\begin{cases} p_i = \lambda_A \frac{\partial F_A}{\partial q_i} \\ t_A = -\lambda_A \frac{\partial F_A}{\partial E_A} \end{cases}$$

The correspondence between the social optimum and decentralized equilibrium is released if and only if:

$$t_A = - \sum_{j=1}^{j=n} \lambda_j \alpha_j \frac{\partial U_j}{\partial E_j}$$

with

$$\frac{\partial U_j}{\partial E_j} \leq 0$$

As so  $\lambda_j = \lambda_A$  et  $p_i = \alpha_i$ .

The optimal unit tax imposed on the tanker ship A corresponds therefore to the sum of marginal damages that the externality imposed to  $j$  consumers, evaluated at the optimum, and expressed in monetary units via the inverse of the marginal utility of income  $\lambda_j$ .

In fact, it corresponds to the consent to pay so as to obtain a reduction of the externality of a single unit (Idelhakkar, 2011). This is because externality is a public good. A reduction of one unit of externality is to all of the consumers who suffer damage.

It is the externality itself which is taxed and not the production.

The taxation of the output is only possible within the very particular case of a technology in which externality is proportional to production. However, the possibility of substitution between inputs is refrained, which can lead to a significant reduction of the policy. The Pigouvian tax can indeed be seen as an incentive instrument to invest in cleaner technologies.

### Responsibility of International Maritime Organization

The dilution framework of responsibilities and the lack of transparency that characterize the financial rules of the sea under the International Maritime Organization (IMO) has effective and efficient mechanisms in place for the elaboration, development and adoption of international treaties. Rules and regulations and their implementation through the tacit acceptance

procedure are also adopted for amendments to most fundamental international conventions.

IMO provides technical assistance to developing countries – individually and collectively– for establishing effective national Port State Control capacities, or regional mechanisms of co-operation for Port State Control activities.

We particularly believe that the absence of an unlimited, coherent and preventive responsibility of a national regime to be applied to oil transport by the sea, both at national and international levels. This allows the maritime actors and their shippers to bear an inconsistent risk with the preservation of the environment which remains viable in case of disaster.

Unlike the UN agencies, the IMO does not work on the principle of "one state - one vote" but according to the relative weight of States -in respect of maritime transport.

Consequently, flags of convenience such as Liberia, Panama, Malta and the Bahamas, which represent 40% of maritime traffic, make out a law of it. The rules of the IMO Maritime suffer from this backing of the lobby of private operators, ship owners, charterers and major petroleum owners. Flags of convenience are countries that offer tax advantages, a social right and a discount on almost total laxity in regulation (inspection of ships, etc. ...).

#### The Contribution of ISM Code (International Safety Management)

By the ISM code (International Safety Management) IMO (International Maritime Organization), the port State intervenes in the quality management of shipping. The ISM poses on weapons to perfect the quality management procedures and it tends to embody their organization on the ground.

The code foresees many measures relating to safety and protection of the environment, application of the manuals' procedures, defining rules of communication between members of staff on land and at the sea, the development of emergency procedures, a regular audit and reporting systems (Neumeister. 1993).

#### *The Performance of Direct Actors' Oil Transport*

We are interested here in the participation of the freighters and traders and petroleum ship-owners of total quality management.

#### *Quality Management of the Freighters and Traders*

Quality, in the freighter's opinion is managed with the

participation of the oil traders. The latest are often integrated in oil companies, which are large shippers, in the shipping oil market. The traders relate, in their transactions, to ship-owners and petroleum freighters.

#### Consistent and Automatic Applications

The efficiency of direct controls depends too much, in its application, on the momentary popularity of anti-pollution and economic interests at stake. It should not, however, ignore all regulations. These are essential in some areas, such as hazardous waste control. Economic instruments that seek to integrate environmental factors in our economic system are useful additional direct controls, with which they can be combined to achieve better results in the fight against pollution.

International law establishes the principle of freedom of navigation on the international seas and the right of innocent passage through territorial waters of States (LEONARD.

1993) International law is framed by international conventions which are binding on States that have ratified them and therefore the ships under their jurisdiction.

Charterers shall ensure in their charter contracts that the ship-owner with whom they contract complies with these conventions. Beyond the law, it is also the right of the port State and the right of the flag State.

In terms of risk prevention, including the risk of maritime safety, the most important international conventions is that of the Safety of Life at Sea, known as SOLAS, adopted in 1960 and 1974. Its objective is to establish minimum standards for construction, equipment and operation of ships. States flag vessels have the responsibility to ensure that vessels flying their flag comply with the provisions of the Convention. The Contracting Government may inspect vessels of other Contracting States, if there is a reason; believe that the ship does not comply with the provisions of the Convention.

The risk of pollution is taken into account by several conventions.

The Torrey Canyon accident in 1967 and its media have been critical (Jean-Pierre Queneudec 1981). It was the first major oil accident, after which the International Maritime Organization, affiliated to the UN, has been initiated by the adoption of several international conventions.

The first is the MARPOL Convention of 1973/1978, which establishes rules designed to prevent and minimize pollution caused by ships, whether accidental or due to routine operations. Beyond these agreements, we must also recognize the voluntary efforts of industry, either the ship-owners or oil companies.

## Conclusion

The damages of the spill are equal, by definition, to reduced ecosystem services affected by pollution. This definition led to wide acceptance of the concept of damage as it integrates the downturns experienced by the market sectors depending on the quality of the environment (fishing, shellfish aquaculture, tourism).

It should be recalled that four solutions were considered for the evaluation of ecological damages: The first is to apply a market price to the destroyed biomass.

It is an arbitrary approach since prices resulted from the interaction of supply and demand. The second relies on the functioning of food chains, lost biomass corresponding to their lower levels; the losses can be translated in terms of marketable species. Its implementation faces two major problems, firstly the uncertainty of the coefficients of passage between tropic levels, and the choice of shadow prices where the destroyed volumes were very high. A third approach is to value the loss of biomass from the prices paid by the laboratories for non-commercial species. It is only applicable to small oil spills; the effects are not likely to affect those prices. In line with this approach, a fourth option was preferred. It was established on claims based on the cost of restoring the environment. One of them, corresponding to a readymade program was accepted.

However, an ambitious program of restocking was not selected as it had not been undertaken and it was to improve the ecosystem, not to restore it (United States District Court, 1988).

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